

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

**In the Matter of**

**The Development of Operational,  
Technical and Spectrum Requirements  
for Meeting Federal, State and Local  
Public Safety Agency Communication  
Requirements through the Year 2010**

**Establishment of Rules and Requirements  
for Priority Access Service**

**WT Docket No. 96-86**

**RECEIVED**

**DEC 2 - 1998**

**FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY**

**To: The Commission**

**PETITION FOR CLARIFICATION**

The Dataradio Group of Companies ("Dataradio"), by its attorneys and pursuant to Section 1.429 of the rules of the Federal Communications Commission ("FCC" or "Commission"), hereby submits this Petition for Clarification of the *First Report and Order*<sup>1</sup> adopted in the above-captioned proceeding. Specifically, Dataradio requests that the Commission clarify, and amend if necessary, the implied over-the-air bit rate for 50 kHz and 100 kHz channels. In seeking this clarification, Dataradio's intent is to ensure that affordable state-of-the-art equipment will be available to all public safety agencies, especially those serving lower density population jurisdictions.<sup>2</sup>

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<sup>1</sup> *In re* The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements through the Year 2010, *First Report and Order*, WT Docket No. 96-86, FCC 98-191 (rel. Sept. 29, 1998).

<sup>2</sup> Throughout this Petition for Clarification, Dataradio will use the term "lower density jurisdictions" to refer, collectively, to political subdivisions in the United States that contain relatively small numbers of residents compared to major metropolitan areas. It is axiomatic that the number of police, fire and other public safety vehicles in operation in a given subdivision

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## **I. STATEMENT OF INTEREST**

The Dataradio Group of Companies consists of Dataradio, Inc., Dataradio Corporation and Johnson Data Telemetry Corporation. The Dataradio companies are engaged in the development, manufacturing and implementation of wireless products and networks that support data applications for both mobile and fixed uses by public safety and private wireless users.

Dataradio is the leading provider of mobile computing network infrastructure for private users in the United States. Dataradio works closely with more than 100 application software and middleware partners and all major mobile radio manufacturers to supply a wide range of services and products for its customers. To date, Dataradio has sold approximately 500 public safety mobile data networks, with public safety systems accounting for 60 percent of Dataradio's sales of private mobile data networks. Dataradio's close business relationships with numerous public safety agencies, including agencies in small jurisdictions, have heightened Dataradio's awareness of the need for technologically-advanced and efficient data transmission equipment that can be afforded by even the smallest public safety user.

## **II. OVERVIEW: A DISCUSSION OF "BANDWIDTH ECONOMICS"**

Underlying this Petition for Clarification is the recognition, based on Dataradio's familiarity with the capabilities and constraints of public safety entities, coupled with its knowledge of the types of critical communications capabilities that most agencies would like to

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tends to vary in direct proportion to the number of people living in the subdivision. Lower density jurisdictions do not require, and generally cannot afford, as many public safety vehicles as those jurisdictions with large populations.

have and should be able to afford, that public safety agencies in lower density jurisdictions will generally neither require nor use 150 kHz channels for their wideband mode of transmission. Instead, agencies in lower density jurisdictions will typically employ 50 kHz and 100 kHz channels as the wideband channel of their public safety communications networks.

When implementing new communications networks, lower density jurisdictions invariably design their systems on the basis of three principal criteria: (1) cost, (2) the required range and coverage of the system,<sup>3</sup> and (3) the average number of vehicles that each base station will serve.<sup>4</sup> Ultimately, these same three factors are fundamental to a proper understanding of “bandwidth economics.”

The fundamental premises underlying the concept of “bandwidth economics” are twofold: *first*, public safety agencies will necessarily limit expenditures for communications networks to an amount that is reasonable within the context of their overall budgets; and, *second*, public safety agencies will purchase only as much communications capacity as required to serve identifiable needs.

Further, in making their communications planning and purchasing decisions, public safety agencies must recognize, and incorporate into their decisions, essential factors that affect the three principal planning criteria. Public safety agencies must recognize, for example, that

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<sup>3</sup> Though lower density jurisdictions have smaller populations than major metropolitan areas, the communications networks implemented by lower density jurisdictions often must serve bigger geographic areas, measured in terms of square miles, than large municipalities.

<sup>4</sup> According to available industry statistics, in roughly half of all the local jurisdictions in the United States, the police departments operate with 50 or less vehicles. There are approximately 167,000 total vehicles operated by police departments in local jurisdictions. Approximately 88,580 of these vehicles are in jurisdictions in which the police departments have 50 or less vehicles. Clearly, lower density jurisdictions do not have the same requirements for wideband transmission channels as municipalities having large populations.

employing a higher bit rate causes a reduction in system range and coverage. This is a particularly important consideration for jurisdictions that cannot compromise on range but must, for cost considerations or other reasons, limit the number of base stations used within their systems. Another important factor that lower density jurisdictions must consider is that, if they should choose to implement a network that affords high capacity data transmission rates, the overall cost of the system will be significantly higher. For these and other reasons, therefore, high capacity data transmission systems are not necessarily consistent with the needs and budgetary constraints facing lower density jurisdictions, especially those in rural areas that encompass large geographic territories.

After due consideration of all the factors that influence “bandwidth economics,” especially as that concept applies to lower density jurisdictions, Dataradio concludes that the minimum data efficiency standards applicable to 50 kHz and 100 kHz channels must reflect a reasonable balance of an attractively (but not overly aggressive) high bit rate, useful range and coverage, and reasonable cost.<sup>5</sup>

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<sup>5</sup> The text of Section 90.535(c) adopted in the *First Report and Order* in the instant proceeding sets a definable transmission standard of 384 kbps for 150 kHz channels. This same rule section speaks of an “equivalent” bit rate for wideband channels of less than 150 kHz. Though the rule does not specify with particularity a standard for 50 kHz and 100 kHz channels, interpolation of the standard for 150 kHz channels would result in a minimum bit rate of 128 kbps for 50 kHz channels and 256 kbps for 100 kHz channels. In this Petition, Dataradio seeks clarification of the transmission standard for 50 kHz and 100 kHz channels. To the extent that the Commission intended the standard to be 128 kbps for 50 kHz channels and 256 kbps for 100 kHz channels, Dataradio urges the Commission to adopt standards that are more consistent with the needs and budgetary capabilities of lower density jurisdictions.

**II. THE BIT RATES APPLICABLE TO 50 kHz AND 100 kHz CHANNELS MUST BE AT LEVELS THAT WILL ENSURE PRODUCTION OF STATE-OF-THE-ART NETWORKS THAT ARE AFFORDABLE BY ALL PUBLIC SAFETY USERS.**

Dataradio applauds the Commission for its efforts to advance the telecommunications capabilities of public safety entities. Dataradio especially acknowledges the Commission's grasp of the inherent differences between commercial, and many private, spectrum users, and public safety entities. The Commission aptly notes that:

While the public generally values public safety communications, their provision is not generally the result of market-driven forces. Instead, jurisdictions provide public safety communications to better protect the safety of life and property. How jurisdictions meet these needs may have more to do with budgetary considerations than considerations of what are the most efficient and effective technologies.<sup>6</sup>

Dataradio appreciates the Commission's desire to make the most spectrally-efficient use of the 700 MHz band. Based on its extensive experience, Dataradio is certain that over-the-air bit rates<sup>7</sup> for the wideband segment of the band can be established at rates that will allow for the production of less expensive equipment while still maintaining necessary spectrum efficiencies. In turn, this cost savings will be passed on to the public safety community, with the

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<sup>6</sup> *In re* The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communications Requirements Through the Year 2010, Establishment of Rules and Requirements for Priority Access Service, *First Report and Order and Third Notice of Proposed Rulemaking*, WT Docket No. 96-86, FCC 98-191, (rel. Sept. 9, 1998) at ¶ 37.

<sup>7</sup> Dataradio confines its discussion to over-the-air bit rates (bits per hertz). Dataradio notes that the *Order* at times uses the term "throughput," which encompasses many more factors, such as error correction and multiple bits per symbol, that raise special efficiency considerations. Dataradio feels that marketplace demands should dictate the "throughput" of equipment, since the Commission is ill-equipped to dictate standards for design factors that, for purposes of some users, may be optional. Dataradio assumes that the *Order* uses the term "throughput" to mean over-the-air bit rates, but suggests that the public would benefit from clarification of this term and its use within the *Order*.

end result that all public safety users will have access to affordable state-of-the-art equipment.

Section 90.535(c) of the newly adopted rules, if applied proportionally to the narrower channel bandwidths of 50 kHz and 100 kHz, implies bit rates of 128 kbps and 256 kbps, respectively. While these bit rates would ensure a high quality of transmission and receipt of image and slow motion video, they necessarily entail a much greater, and unnecessary, expense.<sup>8</sup> Shannon's Law<sup>9</sup> dictates that as the bit rate in a given channel bandwidth increases, the signal-to-noise ratio becomes increasingly less favorable. According to Dataradio's calculations, for every doubling of transmission speed, with all other factors being equal, there is required a minimum of 3 dB additional power that must be implemented in order to maintain a steady and reliable level of communications. An increase in bit rate predicts a definable reduction in the effective range of mobility.<sup>10</sup> Under the Commission's rules, mobile power cannot increase above 30 watts, which means that accounting for increases in transmission speed must be accomplished by building more closely-spaced base stations. For most small and medium-sized jurisdictions, and particularly entities such as Native American Indian tribes occupying largely undeveloped and wide-spread reservations, budgetary constraints absolutely foreclose the ability to invest in redundant, ubiquitous infrastructure.

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<sup>8</sup> In contrast to FM radios, linear radios are very expensive, *e.g.*, \$3,000 for a linear mobile radio versus less than \$1,000 for a comparable FM mobile radio.

<sup>9</sup> Shannon's Law: A statement defining the theoretical maximum rate at which error-free digits can be transmitted over a bandwidth-limited channel in the presence of noise, usually expressed in the form  $C = W \log_2(1 + S/N)$ , where  $C$  is the channel capacity in bits per second,  $W$  is the bandwidth in hertz, and  $S/N$  is the signal-to-noise ratio. [Http://www.its.bldrdoc.gov/fs-1037/dir-033/\\_4816.htm](http://www.its.bldrdoc.gov/fs-1037/dir-033/_4816.htm).

<sup>10</sup> Mobile radios that are 50 percent less sensitive diminish the effective range by approximately one-fourth.

Dataradio urges the Commission to carefully weigh the advantages of gilded technology against the cost of implementing engineering advancements in order to strike a balance that permits the public to reap the benefits bestowed by the *First Report and Order*. In many cases, the 384 kbps/150 kHz bit rate far exceeds the demands of public safety entities in smaller jurisdictions. Additionally, the costs associated with this bit rate will undoubtedly prohibit many public safety users from taking advantage of imaging and video. Smaller jurisdictions predictably utilize fewer vehicles per channel than large population areas. In a major metropolitan environment, it would not be unusual to have a loading of 200 vehicles per channel. Using 384 kbps, the average user would have at its availability a bandwidth of 1.92 kilobits per hertz. By contrast, a smaller jurisdiction might have only 50 or less vehicles per channel. In such cases, a rate of 0.77 or 1.12 kilobits per hertz for a single user is generally adequate, as the demand for shared use of the channel is decreased. In addition, the range-per-watt-of-power ratio would be more favorable at slower bit rates, meaning that less terrain would be sterilized compared to higher power.

Using a more reasonable bit rate in the 50 kHz and 100 kHz wideband channels would not preclude using higher speed transmissions should the conditions or demand warrant. To the contrary, Dataradio envisions a more flexible scale for wideband transmission rates that would embrace the gamut of agency needs and budgets throughout the country. An optimum scale would permit the manufacture and utilization of equipment designed consistently with the Commission's refarming policy of 19.2 kilobits per 25 kHz of bandwidth. This would require a minimum bit rate of 38.4 kbps and 76.8 kbps for 50 kHz and 100 kHz channels, respectively. This bit rate maintains a reliable integrity of signal with good mobility range in equipment that

will be affordable to smaller jurisdictions. In no event should the minimum required bit rate exceed 56 kbps/50 kHz and 128 kbps/100 kHz, although manufacturers should be free to design equipment based on a 384 kbps/150 kHz ratio to suit the needs of larger metropolitan areas.

To meet the needs of smaller jurisdictions, Dataradio is poised to commence production of a line of radios with 56 kbps for 50 kHz channels and 128 kbps for 100 kHz channels. This line was devised on the basis of the needs expressed to Dataradio by public safety agencies with relatively small equipment budgets. Dataradio would like to begin filling the void of advanced telecommunications capabilities in smaller markets so that these types of jurisdictions may also take advantage of the Commission's public safety initiative in the 700 MHz band. It cannot do so, however, until the Commission clarifies, and adjusts if necessary, the minimum bit rate intended for 50 kHz and 100 kHz channels. Dataradio does not doubt that there are public safety agencies in major cities in this country that need and can afford equipment with a 384 kbps/150 kHz bit rate ratio. However, this is simply not the case in the majority of smaller jurisdictions. As time decreases the cost of today's newest advancements, such equipment may eventually become affordable for smaller jurisdictions as well. For the present, however, smaller jurisdictions should be able to take *immediate* advantage of all the latest advances available to their larger urban counterparts, and not be forced by artificial regulatory constraints to have to wait until equipment prices come down.

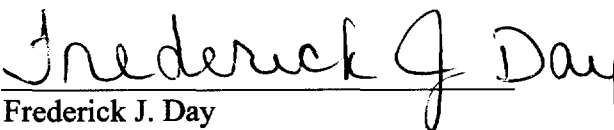


### **III. CONCLUSION**

Dataradio's familiarity with the capabilities and constraints of public safety entities, coupled with its knowledge of the types of critical communications capabilities that most agencies would like to have and should be able to afford, has prompted Dataradio to seek clarification and/or amendment of the wideband bit-rate standard to better serve the public interest. For the reasons stated above, Dataradio respectfully requests that the Commission clarify and/or amend the bit rate requirements for wideband channels less than 150 kHz and implement a permissible standard incorporating bit rates that are no greater than 56 kbps and 128 kbps for 50 kHz and 100 kHz channels, respectively.

**Respectfully submitted,**

**DATARADIO GROUP OF COMPANIES**

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